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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/663,799

09/17/2003

Takashi Yoda

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3768

7590

01/11/2005

Finnegan, Henderson, Farabow,
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EXAMINER

CAO, PHAT X

ART UNIT

PAPER NUMBER

2814

DATE MAILED: 01/11/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/663,799	YODA ET AL.	
	Examiner	Art Unit	
	Phat X. Cao	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 November 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 7-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4 and 6 is/are rejected.
- 7) ☒ Claim(s) 5 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>9/17/03</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Applicant's election of Group I (claims 1-6) in the reply filed on 11/2/04 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Specification

2. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Rejections - 35 USC § 112

3. Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 2 is unclear because claim 2 is generally narrative and indefinite, failing to conform with current U.S. practice. It appears to be a literal translation into English from a foreign document and is replete with grammatical and idiomatic errors.

For the examination purpose, the mixed layer in claim 2 is assumed as a layer constituted by the porous film and the same component as the conductive barrier layer in the open cells of the porous film.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

5. Claims 1, 4, and 6 are rejected under 35 U.S.C. 102(e) as being anticipated by Ito et al (US. 2003/0116854).

Regarding claim 1, Ito (Fig. 8E) discloses a semiconductor device comprising: a Porous film 14 (par. [0048]) formed above a semiconductor substrate 24, the porous film 14 having at least one burying concave 17 (Fig. 8B) selected from the group consisting of a trench and a hole; a conductive barrier layer 18 of Ta, Ti or Nb (par. [0049]) formed on the inner surface of the burying concave; a conductive member 19 in the burying concave with the conductive barrier layer 18 interposed between the porous film 14 and the conductive member 19; and a mixed layer 23' formed between the porous film 19 and the conductive barrier layer 18, and containing a component of the porous film 19 (par. [0082]) and a component of the conductive barrier layer 18 (i.e., Ta, Ti or Nb) (also see par. [0082]).

Regarding claims 4 and 6, Ito (Fig. 8E) further discloses that the conductive barrier layer 18 is made of TaN (par. [0060]), and the mixed layer 23' has a thickness of at least 1 nm and less than 100 nm (par. [0053]).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 1-2, 4, and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ogure et al (US. 2001/0055649) in view of Dalton et al (US. 2003/0057414).

Regarding claims 1 and 4, Ogure (Fig. 17C) discloses a semiconductor device comprising: an organic insulating film MSQ 230 (par. [0014]) formed above a semiconductor substrate 208 (not shown, see par. [0125]), the MSQ 230 having at least one burying concave selected from the group consisting of a trench and a hole; a conductive barrier layer 233 of TaN (par. [0125]) formed on the inner surface of the burying concave; a conductive member 516 (not shown in Fig. 17C, see Fig. 28) buried in the burying concave with the conductive barrier layer 233 interposed between the MSQ film 230 and the conductive member; and a mixed layer 231 formed between the MSQ film 230 and the conductive barrier layer 233, and containing a component of the MSQ film 230 and a component of the conductive barrier layer 233 (see Par. [0126]).

Ogure does not disclose that the organic insulating film MSQ 230 is a porous film.

However, Dalton (Fig. 8) teaches the forming of an electrical contact within a porous MSQ film 14 (abstract). Accordingly, it would have been obvious to form the MSQ film 230 of Ogure as a porous MSQ because as taught by Dalton, such porous MSQ would have significantly improved dielectric constant (also see abstract).

Regarding claim 2, because the MSQ film is a porous film, the mixed layer 231 containing the component of the porous film and the component of the conductive barrier layer would exist in the open cells of the porous film.

Regarding claim 6, Ogure does not disclose the mixed layer 231 having a thickness range as claimed. However, Ogure teaches that the mixed layer thickness 231 is formed in the range of desirable particle energy values from 800 eV to 2 MeV in order to obtain the necessary adhesion strength and to prevent the damage to the device (par. [0148]). Therefore, it would have been obvious to form the mixed layer of Ogure with the desirable thickness range as claimed in order to obtain the necessary adhesion strength and to prevent the damage to the device.

8. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ogure et al and Dalton as applied to claim 1 above, and further in view of Ting et al (US. 5,969,422).

Neither Ogure nor Dalton disclose that an aspect ratio (D/W) of the burying concave is 1.5 or more.

However, Ting (fig. 1) teaches the forming of an interconnect pattern in a burying concave (contact hole) having an aspect ratio of 4:1 or greater (column 11, lines 63-67). Accordingly, it would have been obvious to form the interconnect pattern of Ogure in a

burying concave having an aspect ratio as claimed because as taught by Ting, such high aspect ratios of the interconnect patterns would minimize the device sizes by minimizing interconnect pattern spacings (column 1, lines 14-22).

Allowable Subject Matter

9. Claim 5 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The prior art of record fails to disclose the concentration of the mixed layer as claimed.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phat X. Cao whose telephone number is (571) 272-1703. The examiner can normally be reached on Monday - Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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PC
January 6, 2005

A handwritten signature in black ink, appearing to read 'Phat X. Cao', with a stylized, flowing script.

PHAT X. CAO
PRIMARY EXAMINER